Riparian and Wetland Classification Review

I. Introduction

In recent years a large number of riparian and wetland classification and description procedures have been developed and/or modified by many investigators. Riparian and wetland managers have seen this myriad of procedures and basically have been confused about which one to use and what they are supposed to do. The following riparian and wetland classification and description procedures were selected for review from a very lengthy list because they have one or more of the following characteristics: they are regional or national in scope; they provide management information; and they integrate stream attributes and riparian vegetation.

1. SCS-BLM Standard Ecological Site Description.
2. Southwestern Wetlands — Their Classification and Characterization.
3. The Canadian Wetland Classification System.
4. Riparian Zone Associations of the Deschutes, Ochoco, Fremont, and Winema National Forests.
5. Classification and Management of Riparian and Wetland Sites in Montana.
6. Classifying Rangeland Riparian Areas: The Nevada Task Force Approach.
7. Classification of Riverine Riparian Habitats for Management of Fisheries Resources.
8. An Ecological Characterization of Rocky Mountain Montane and Subalpine Wetlands.
9. Ecosystem Classification Handbook.
10. Classification of Wetlands and Deepwater Habitats of the United States.
11. Riparian Community Type Classification of Eastern Idaho-Western Wyoming.

II. Purpose

It is the policy of the Bureau of Land Management (BLM) to apply the Standard Ecological Site Description procedure patterned after the Soil Conservation Service (SCS) Range Site procedure and expanded by the BLM (USDA-SCS 1976, USDI-BLM 1990) to grazable woodland, native pasture, and riparian sites. However, other classification and description procedures exist and often must be used to make use of all available information or to coordinate between other agencies and institutions during riparian and wetland inventory. This document introduces major concepts relevant to the understanding of riparian systems and reviews selected riparian and wetland classification and description procedures. This document also provides a means of relating the various procedures. Appendix A contains a crosswalk of those reviewed classification and description procedures that can be readily applied to riparian site descriptions and concepts of vegetation succession and site progression discussed below. Appendixes B-E provide information and define terminology that should help in understanding and applying classification and description procedures.

III. Vegetation Succession and Site Progression

Succession usually represents an orderly progression (except in cases of fire, etc.) of plant community change, towards a relatively stable state often termed the "potential natural community" (PNC) or "potential plant community" (PPC). These changes in plant communities may also accompany important refinements in certain environmental characteristics, such

as physical properties (e.g., organic material in the soil), soil chemistry, soil moisture, understory solar radiation, root distribution, populations of insects and animals, and appearance. These changes are often made possible through the behavior of the site's environment (particularly soil and water). The ability to discern these environmental factors from one site to another is a basis for ecological classification. Often, the plant community is used as an indicator of these integrated environmental factors.

Currently, the most frequently used procedure of classifying community ecology follows the concepts introduced by Daubenmire (1959). Many recent authors have used these concepts in their work with riparian and wetland environments (Youngblood et al. 1985, Kovalchik 1987, Hansen et al. 1988, Hansen 1989, Szaro 1989). These authors demonstrate that the concepts of succession used in upland environments are equally applicable to riparian systems, although the riparian site is generally much more dynamic. It is useful in further comparison and discussion to review some of the basic terminology and concepts applied in these recent documents:

> Association - In normal usage, an association is a climax community type or potential plant community. In riparian systems, because of their dynamic nature, a true climax community may not have an opportunity to occur (Youngblood et al. 1985). An association for a riparian environment is therefore a plant community type representing the latest successional stage attainable on a specific hydrologically influenced surface (Kovalchik 1987, Hansen 1989). Hansen (1989) uses the term "riparian association" while Youngblood et al. (1985) chose the term "potential stable community type" that approaches an association.
>
> Community Type - This is defined as an aggregation of all plant communities in some procedures, or as existing/dominant plant communities in others. Community types are distinguished by floristic and structural similarities in both overstory and undergrowth layers. Community types are considered to represent seral stages.
>
> Site Type - This is the area of land occupied or potentially occupied by a specific association. Site types that were the same would have similar environments that could develop the same potential plant community. Hansen (1989) uses the term "riparian site type" when describing a site capable of producing a "riparian association."

Figure 1 offers two similar views of successional concepts. Hansen (1989) provided an illustration, shown in part a of Figure 1, to depict the relationship between site type, community type, and association.

The illustration shows that community types are seral to associations (potential natural communities) and that some community types are common to one or more associations. It also shows that one site type (range type in part b of Figure 1) supports one association (PNC).

In many riparian systems there is a high potential for physical environments to undergo sudden and/or extreme changes because of the potential for soil erosion, deposition, and changes in water availability. Youngblood et al. (1985) stated "Directional processes from one community type to another indicate succession; we have not attempted to indicate the

many possible relationships resulting from retrogression." This acknowledges succession and the complexity of possible community types due to site change. To help emphasize that these changes are the rule rather than the exception in riparian environments, we have introduced the term "site progression" which denotes major changes in the site. Site progression is not intended to diminish or replace any of the concepts of community succession; rather, it is a term to help those less familiar with the dynamics of riparian systems focus on the expectation for site change. Generally, site progression can be thought of as a site change which may result in a different potential natural community for the site. An example of this would be a site located on a flood plain consisting of fine substrate that undergoes extreme incisement, eventually changing the site from a moist to a very dry environment. The site progression is also seen in the succession of a gravel bar to an eventual nonflooded, cottonwood dominated terrace. In Figure 1, site progression would be seen as a site change between columns of the site types (riparian and/or habitat types) or cones. Figure 2 is a representation of site progression.

Additionally, for a classification or site description to be very useful to management it should recognize and discuss site succession, site progression, and site potential and what makes them occur, thereby offering managers a means for rational management.

> "It is important to remember that not all the landscape is at its potential. In fact, only relatively small amounts are. However, by knowing what the potential is, a manager can understand the processes and how to best manage for them." (Paul Hansen, pers. commun.)

We refer to this as an understanding of "process pathways." Once the process pathways are recognized, management can better understand cause and effect relationships.

IV. Riparian Health and Ecological Site Status

Riparian health has been related to ecological site status in recent years. This is a dangerous and functionally impossible view of how riparian systems operate. The following paragraphs discuss the concepts of ecological site status and riparian health in hopes that a more clear understanding of riparian system function will result.

Ecological site status refers to the position on a successional pathway that a particular site may be in. For example, a newly vegetated gravel bar may be covered with pioneering plant species such as cottonwood and willow. This site is said to be in early seral stage because it is at the beginning of its successional pathway. It is also in a frequently flooded state, allowing deposition interspersed with scoured flow patterns. As vegetation succession occurs and aggradation continues, young cottonwood trees may dominate an understory adapted to frequent or occasional flooding. As long as the relationship with flooding frequency and timing is maintained to allow cottonwood regeneration (not allowing the young cottonwoods to effectively trap sediments or become older), vegetation succession cannot proceed and could be considered in an advanced stage for that particular set of physical circumstances. However, if aggradation has occurred far enough (which may be directly related to the presence of the cottonwoods) or stream channel migration relegates the site to a rarely flooded or nonflooded state, the cottonwoods may persist to a decadent stand. Regardless of the longevity of the cottonwoods at this location, site progression has evolved to a new state allowing vegetation succession to proceed to a new potential dominated by ash or perhaps

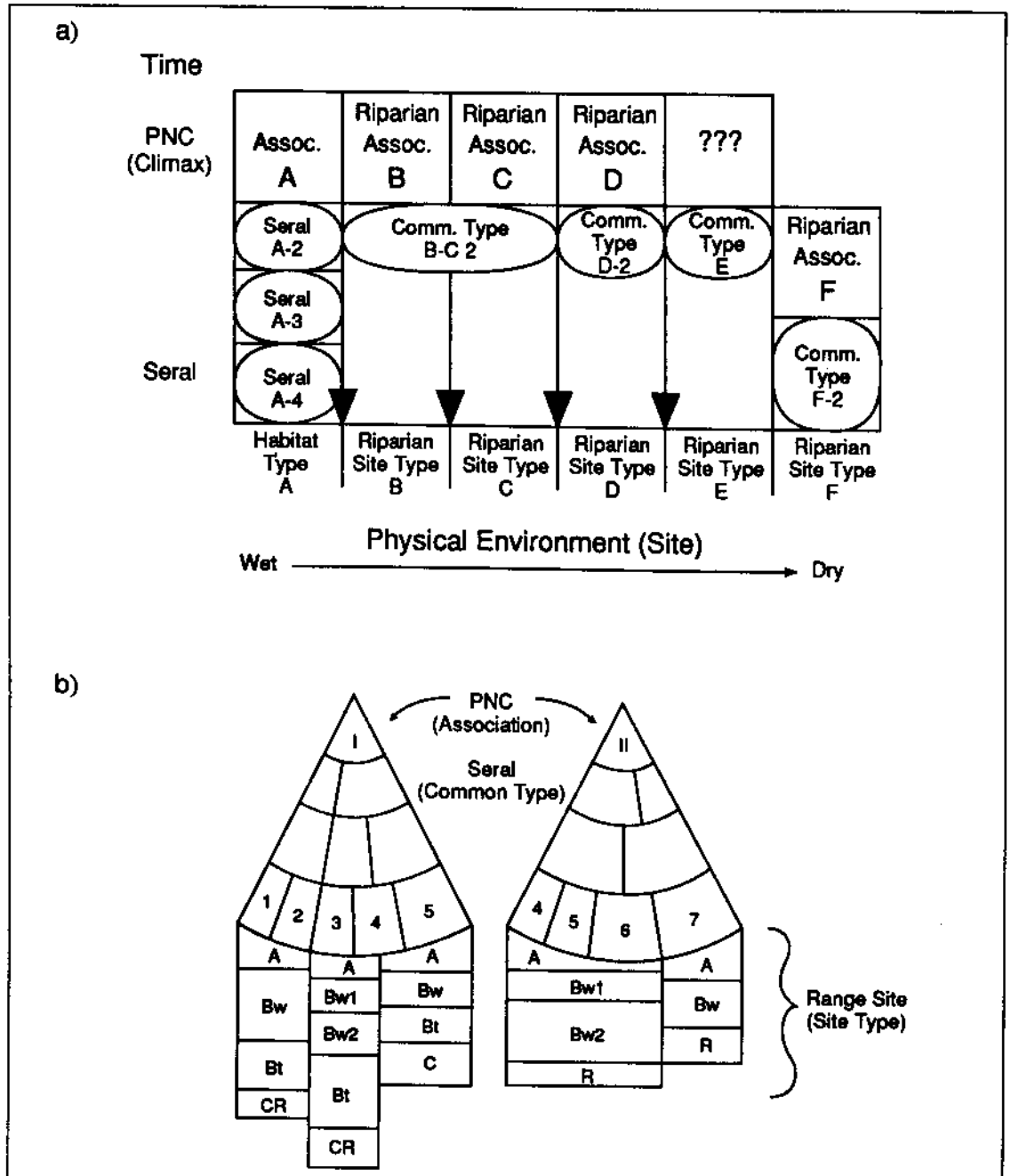

Figure 1. Comparison of Two Successional Models. a) Illustration of classification terminology as it relates to time and the physical environment (site) for riparian areas, after Hansen (1989). b) Conceptual "cone" model of secondary successional plant communities developed by Huschle and Hironaka, and Neiman, Jr. and Hironaka, modified to illustrate terms as shown in "a" above, and those typically used within range site descriptions. Depicted are two range sites, seral plant communities, and range site specific soil units. Note seral plant communities 4 and 5 can occur in two sites having different potential natural communities (potential plant communities).

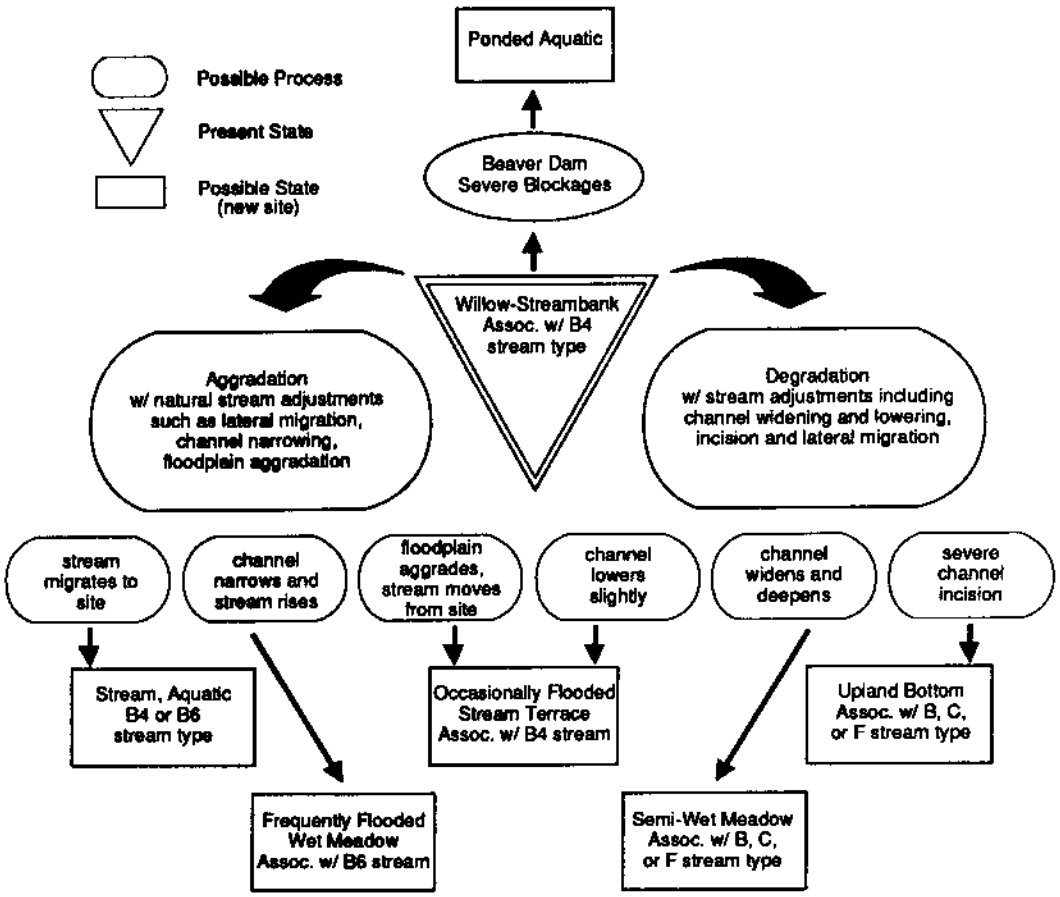

Figure 2. Concept of Site Progression. The boxes represented as "states" may include a number of different site types and may be found associated with stream types (i.e., B4, B6, etc.) as described by Rosgen (1985).

other self-perpetuating species. The decadent cottonwood stand is now an early successional stage to a different potential natural community. Vegetation succession may or may not be allowed to proceed long enough to reach that new potential, depending on stream dynamics and hydrology in relation to the valley bottom morphology.

Since riparian systems are dynamic, some may never be able to attain a climax community, or at least not attain it without long term evolution of existing valley bottom morphology. A stream flood plain developing within the walls of a past incisement provides such an example. The soil-water-plant relationships within the developing flood plain may provide the same wet meadow/meadow complex of site potentials as found elsewhere. The stream channel may be aggrading at approximately the same rate as the adjacent flood plain. Site progression, in this case, is actually increasing the aerial extent of the riparian vegetation (and associated ground water) as the system aggrades. The system is in an excellent functional

state. However, the forming and reforming of plant communities due to the increased frequency of deposited sediments limits vegetation succession to early and mid-successional status. This will be the case until the geomorphic processes of aggradation slow sufficiently to allow vegetation succession to proceed.

Riparian health must be viewed with the understanding that the riparian system is inherently dynamic. The condition (abundance, vigor) of the vegetation on a site would be only one attribute of riparian health. The riparian health should be evaluated in terms of physical and biological function in relation to the *entire watershed.* The following excerpts from Gebhardt et al. (1990) introduce this concept:

> "The interaction of watershed characteristics and vegetation can be described in terms of physical and biological processes and factors. Such processes and factors can be grouped by physical and biological characteristics. The U.S. Fish and Wildlife Service (1989) identified the major vegetal biological characteristics or responses as survival-maintenance, recruitment-reproduction, and community dynamics. The major physical characteristics follow the watershed characteristics described above grouped as moisture/inundation (water quantity), physical and chemical water quality, transport/deposition, and channel/floodplain geometry. Our responsibility is to understand their importance to the riparian system, particularly in terms of their rates, magnitude or extent, and duration."

The processes and associated factors controlling riparian function are listed in Appendix F.

Riparian health should not be confused with ecological site status. A young site or an old site can be in good health, as with any organism. However, one should not assume that a stream in an advanced ecological condition is desirable (or even attainable) in all instances. Some sites, for example, may be at an early or mid-seral ecological status and provide wonderful waterfowl habitat. Provided these sites are in good health, they are serving a very positive function. Another example might be a willow-dominated PNC supporting a trout population. At the PPC and in excellent health, such a site might produce an abundant fish population, but the vegetation density would preclude fishing.

In summary, riparian health and ecological site status are two different characteristics of riparian systems. A site in any ecological status may be in good or poor health. All sites should not necessarily be managed for late seral condition, particularly if it precludes a desired function or beneficial use. Riparian health should be judged on the functions that it provides compared to functions that should be present in relation to the entire watershed. All riparian systems should not be expected to have identical functions.

V. Review Format

Each classification and description procedure included in this technical reference is described and discussed using the following standard format:

Name: Name of the classification or description procedure.

Authors: Authors and/or agencies preparing the procedure.

References: Documents that explain the procedure.

Objectives: Describes the major objectives of the system or procedure as given or estimates the objectives based on contents of the reference.

Designed Users: Estimates likely users of the system.

Area of Applicability: Region, state, or locality where the procedure appears or is proven to be able to work. No discussion on scale is given. The procedures described can be used at about any scale. The size of the areas depicted in the classification will be dependent on the purpose of the classification which will define the detail of the mapping units and the sorting process used to aggregate and separate.

Classification Units, Description, and Data: Units or major contents or data requirements of the classification are given in order of a hierarchical structure, where given, otherwise they will be placed based on the best estimate of the reviewer.

Use, Testing, Validation: Information on use is given, particularly in reference to large-scale testing or validation efforts.

Ease of Application: An estimate is given on how easily the procedure could be applied by professional land resource specialists.

Use in Defining System Response and Potential: System response is the response of a riparian or wetland to various environmental change. Potential refers to the potential natural community as described above. Classification and description procedures may simply provide a method of categorization without regards to environmental response. However, without some ability to define the response and potential, a classification procedure cannot relate to management very effectively. Ties to system response might include both physical and biological factors providing clues to a system's limiting factors such as soil-water regime, substrate, riparian-riverine interaction, channel morphology, flora, and fauna.

Use in Determining State of System: A discussion is included on the procedures handling of succession and site progression, the concepts of which are explained above.

Relation to Other Procedures: Well-known procedures or standards are given if they are known to have been used in the development.

Automated Data Processing (ADP): Where ADP applications have been built for the procedure, they are mentioned.

Limitations and Assumptions: Perceived limitations in accomplishing objectives are given. Assumptions inherent in the procedure are given if they are considered significant.

VI. Classification and Description Procedures

1. **Name:** SCS-BLM Standard Ecological Site Description.

Authors: Soil Conservation Service, Bureau of Land Management.

References: U.S. Department of Agriculture. 1976. National Range Handbook, as amended. Soil Conservation Service, Washington, DC.

U.S. Department of Interior. 1990. National range handbook. BLM Manual Handbook H-4410-1. Bureau of Land Management, Washington, DC.

Objectives: The National Range Handbook (SCS) as supplemented by BLM Manual Handbook H-4410-1 National Range Handbook includes procedures for preparing standardized ecological site (range site) descriptions. The National Range Handbook provides for range site descriptions that include a unique name, physiographic features, climatic features, vegetation ecology and production, soils, and management interpretations (which can be used in making management recommendations). BLM Manual Handbook H-4410-1 further provides that the concept also applies to grazable woodlands, forest and riparian/wetland sites.

Early in 1988, BLM determined that the standard site description procedures contained in the National Range Handbook as applied to uplands would accommodate land features associated with riparian and wetland sites as well. These procedures were modified by adding riparian and wetland associated water features and additional descriptions of site dynamics to the standard site description format and the Siteform program.

Designed Users: All levels of land users.

Area of Applicability: Universal application to rangeland, woodland, and native pasture.

Classification Units, Description, and Data:

Classification Units	Description
Physiographic Features	Occurrence of the site in the landscape. Degree and direction of slopes. Range of elevation.
Climatic Features	Range in average annual precipitation, temperature, and seasonal distribution. Average beginning and ending dates of growing season for major native forage species. Other features such as storm intensity, wind velocity, and drought cycles that typify the site and may contribute to or limit its potential.
Vegetation Ecology	Description of the plant community that would become established if all successional sequences were completed without major disturbance under similar environmental conditions (assuming no major site changes such as seen

	with site progression). Concepts of potential plant community, seral ecological status, and seral community apply to this procedure.
	List of major plant species and their normal relative proportion in the total natural plant community.
	Other features, if deemed significant, such as ground cover, plant spacing, and overstory canopy. Descriptions of additional communities that may occur on the site under various stress and/or at different successional stages.
	Estimated total annual production and range in favorable and unfavorable years.
Soils	Briefly describes the main properties of the major soils associated with the site with special significance on important soil-vegetation-water properties.
	Name of major soils and their respective phase associated with the site.
Associated Water Features	Includes information on the morphology and hydrology of associated water system. Typical attributes include stream type (Rosgen 1985), flow regime, erosional/depositional features, surface and ground water features.
Site Interpretation	Information on potential importance of the site for each of its major uses. Includes successional stages and potential to change characteristics (stability) or to change states.
Identification Authentication	Gives location of typical example of the site. Identifies site with the Major Land Resource Areas (MLRA) in which it occurs. Gives information of when the description was approved and the principal author and agency.

Use, Testing, Validation: The procedure in the National Range Handbook is used worldwide to prepare site descriptions for rangelands. These procedures have been modified, tested, and validated for use in preparing site descriptions for riparian areas. Procedures for site correlation exist and are compatible with the National Soil Handbook.

Ease of Application: Ease of application depends on the ability and experience of the users. A team of specialists consisting of a biologist, botanist/ecologist, soil scientist, and hydrologist is required to use these procedures on riparian and wetland sites. The procedures for mapping, delineating, describing, and interpreting sites have been used by several agencies for several years. Sufficient training, review, and correlation is key to the success of the procedure.

Use in Defining System Response and Potential: A major purpose of the procedure is to define community response and the reasons why a particular response occurs.

Use in Determining State of System: The procedure is well suited to identify changes of state and the reasons for site progression (aggradation/degradation).

Relation to Other Procedures: The procedure makes use of other nationally or internationally recognized procedures, such as the National Soil Handbook. It is conceptually similar to others in recognizing a potential or climax plant community and successional stages or communities.

Automated Data Processing: Several levels of data processing assistance are available for the procedure.

Limitations and Assumptions: Use of this procedure is limited by the extent of knowledge of similar sites and by the expertise of the users. Experienced personnel are required to correctly identify site potential. The end product of the procedure is a very useful document for management.

2. Name: Southwestern Wetlands — Their Classification and Characterization.

Authors: David E. Brown.

References: Brown, D.E. 1978. Southwestern wetlands — their classification and characterization. *in*: Proceedings of the National Riparian Ecosystems Symposium, Callaway Gardens, Georgia, Dec. 11-13, 1978. pp. 269-282.

Brown, D.E. and C.H. Lowe. 1973. A proposed classification for natural and potential vegetation in the Southwest with particular reference to Arizona. Ariz. Game and Fish Dep., Fed. Aid Proj. Rpt. W-53-R-22 WP-4JI:1-26.

Objectives: Provide a hierarchical structure for the world's biotic communities based on those factors most important in the evolution of origin, structure, and composition of all ecosystems, both wetland and terrestrial. Recognizes plant components within an assigned ecological distribution and could lead to the species of wildlife expected to be present.

Designed Users: Ecologists, wildlife biologists, zoologists.

Area of Applicability: Everywhere.

Classification Units, Description, and Data:

Classification Units	Description
Biogeographic Realm	Geographic and biologic origin-evolutionary boundaries. Generally very large with the exception of small areas showing high degree of endemism. Seven realms are used: Nearctic (Continental North America exclusive of the tropics and most highland areas south of the Tropic of Cancer); Palaearctic (Eurasia exclusive of the tropics); Neotropical and Antarctican; Oriental; Ethiopian; Australian; Oceanic.
Vegetation	Classed as either upland wetland, or in the case of altered lands, cultivated. All existing and potential natural vegetation are placed in these classes.
Formation Type	Refers to recognized ecological formations (biome interpretation types). Wetland formation types include wet tundra, forest, swampscrub, marshland, strand (unvegetated bank or shore), and submergent.
Climate Zone	Refers to one of four world climate zones (arctic boreal, cold temperate, warm temperate, tropical-subtropical).
Regional Formation	Refers to a subcontinental unit that is a major biotic community (biome) usually centered in but not restricted to a biogeographic region or province possessing a particular precipitation pattern or other climatic regime.

Series	Provides the principal or plant-animal communities within general biomes, recognized and distinguished primarily on distinctive climax plant dominants. These series sometimes referred to as cover types or vegetation types are each composed of one or more biotic associations characterized by shared climax dominants—within the same formation, zone, and biome.
Association	Refers to distinctive plant associations based on the occurrence of particular dominant species more or less local (or regional) in distribution and generally equivalent to habitat types as outlined by Daubenmire and Daubenmire (1968), Layser (1974), and Pfister et al. (1977).
Composition-Structure-Phase	Is a qualitative description of the structure composition, density for the dominants. Most detailed.

Use, Testing, Validation: The reference for this classification system is preceded by many other references (Brown 1973; Brown and Lowe 1973; Brown and Lowe 1974a, b; Brown, Lowe, and Pase 1977) to the extent it should be considered well tested. There was little information sought on its use; however, it is assumed to be in use in the Southwest.

Ease of Application: Half of the categories are developed from existing information. Field work is necessary to classify below the series level and also would be required at the series level in areas where vegetation is not generally identified.

Use in Defining System Response and Potential: The hierarchy of the procedure allows for very general climatic consideration and general animal habitat consideration. The procedure does not deal with geomorphic processes or riverine environments. However, this information could be incorporated easily.

Use in Determining State of System: The state of the system appears inherent at the association level in this procedure. The state of a system in regards to site succession and site progression may be identified, but is not recognized as a part of the procedure.

Relation to Other Procedures: This procedure has placed reliance on existing classification procedures for zoogeography, world climates, wetland determination [through SCS hydric procedures (assumed but not stated in document), world vegetation-habitat zones, and finally successional vegetation procedures of Daubenmire creation].

Automated Data Processing: The procedure was set up in a numeric fashion to facilitate data processing. It is not known whether this procedure has an established data standard through any Federal or State agency, however.

Limitations and Assumptions: This procedure stresses the importance of evolutionary origin and regional adaptation. The upper portions of the classification may have value to the manager concerned with importing exotic species, recovering native species, and identifying potential zones for adaptation. The lower portions of the classification are very similar to many others' procedures and should provide suitable data at a more site or habitat specific level. The classification does not provide physical process information nor was it intended to; however, this does not preclude more elaboration on the user's part.

3. **Name:** The Canadian Wetland Classification System. Provisional — this system is currently being revised and should be released in 1990 (Clayton Rubec, pers. com.).

Authors: National Wetlands Working Group, Canada Committee on Ecological Land Classification.

Reference: National Wetlands Working Group. 1987. The Canadian wetland classification system (provisional edition). Lands Conservation Branch, Canadian Wildlife Service, Environment Canada, Ecological Land Classification Series No. 21. 18 pp.

Objectives: Develop nationally applicable wetland classification system.

Designed Users: Biologists, managers.

Area of Applicability: Canada.
Classification Units, Description, and Data:

Classification Units	Description
Class	Five wetland classes are bog, fen, marsh, swamp, and shallow water.
Form	There are 70 wetland forms differentiated based on morphology, pattern, water type, and underlying soil.
Type	Wetland types are classified according to vegetation physiognomy. These include coniferous and hardwood trees; tall, low, and mixed shrub; forb; graminoid (grass, reed, tall rush, low rush, sedge); moss; lichen; floating and submerged aquatic; and nonvegetated.

Use, Testing, Validation: Procedure is provisional and in the testing processes.

Ease of Application: Procedure is very straightforward. Keys are provided within each class to help a user find the correct form.

Use in Defining System Response and Potential: Form keys contain some physical information that could be used in developing some system responses; however, the intention of the procedure was to strictly classify without addressing response.

Use in Determining State of System: Based on the form key, the descriptions given are very close to what might be considered a system state. However, the concept of succession and progression is not inherent to the procedure.

Relation to Other Procedures: The procedure utilizes standard soil taxonomy. No references to any United States standards could be found.

Automated Data Processing: The data that is collected during the wetland inventory and/or classification is entered into the Canadian Wetland Registry (Kroetsch et al. 1988). This registry system is a computerized data base holding wetland information on location, climate, chemistry, hydrology, soils, and vegetation community or composition.

Limitations and Assumptions: While some of process concepts are handled in the form key, the classification does not attempt to educate the user in why the forms occur. The classification system is meant to be a complimentary text to National Wetlands Working Group, Canada Committee on Ecological Land Classification (1986), entitled "Wetlands of Canada," a definitive knowledge base on Canada's wetlands which serves as both an educational and management reference.

4. Name: Riparian Zone Associations of the Deschutes, Ochoco, Fremont, and Winema National Forests.

Authors: Bernard L. Kovalchik.

Reference: Kovalchik, B.L. 1987. Riparian zone associations: Deschutes, Ochoco, Fremont, and Winema National Forests. USDA Forest Service Region 6 Ecology Technical Paper 279-87 Pacific Northwest Region, Portland, Oregon. 171 pp.

Objectives: This product describes the general geographic, topographic, edaphic, functional, and floristic features of riparian ecosystems. It describes successional trends and predicts vegetative potential on disturbed riparian ecosystems and presents information on resource values and management opportunities. It contributes to the broad regional classification program of the USDA Forest Service, Region 6.

Designed Users: Biologists, foresters, range conservationists, engineers, hydrologists, managers.

Area of Applicability: Central and southern Oregon. Concepts of this system can be applied anywhere.

Classification Units, Description, and Data:

Classification Units	Description
Upland Ecosystem, Transitional Ecosystem, Riparian	While not actually classified, a distinction is made between upland, transitional, and riparian ecosystems. Riparian ecosystems are those next to water where vegetation is on the perpetual water source. Transitional ecosystems occur between the riparian and upland. Transitional ecosystems do not have mesophytic vegetation such as alders, sedges, and willows, yet are markedly different from the uplands. Transitional areas include inactive flood plains, terraces, toe-slopes, and meadows having high water during a portion of the year.
Physiographic Area	This is the broadest level of the classification and integrates similar climatic, geologic, and geomorphic processes.
Riparian Landform	This intermediate level reflects similarities in elevation, valley gradient, fluvial processes, water regime, and soils.
Riparian Association, Community Type, Fluvial Surface	This is the lower level and is determined by site environments reflected in the types of vegetation potentially dominated by the site. Riparian associations (or community types) differ from each other with respect to land management opportunities, can be identified at any level of disturbance, have a limited variation in species composition, and have a limited variability in productivity. The riparian

	association is assumed to be the stable plant community on a particular site provided no major changes in the fluvial surface or water regime occur. Essentially, a community type may be a subset of a riparian association and may develop into a riparian association through normal successional stages of development. A community type (as described, and not one specific site) may also be seral to several riparian associations.
Other Attributes	Additional modifiers include soils, climate, and management information. Management information includes livestock, wildlife and fisheries potential, fire effects, silvicultural production and considerations, potential and pathways for recovery, and related studies.

Use, Testing, Validation: The publication is, in itself, a test and validation. The document is very useful. It includes several keys to define associations and communities from vegetation and landforms. The classification has been in use for 3 years and is well received by U.S. Forest Service managers (Kovalchik, pers. com.).

Ease of Application: The procedure is straightforward. Its ease of application is probably dependent on the experience of the field personnel doing the vegetation mapping and identification. The geomorphic-based alternative for predicting vegetation potential has proved effective for managers without taxonomic skills.

Use in Defining System Response and Potential: The procedure requires some thought to produce system response estimates. Geomorphology, at the landform level (64 landform cross-sections given) along with the geomorphic key to vegetation potential can be very useful in defining system response and is one of the best features of the publication.

Use in Determining State of System: The procedure determines associations (i.e., site succession). Reference are made to other potentials from the association descriptions based on changes in water regime, which is approaching the concept of states and site progression.

Relation to Other Procedures: This procedure relates to standard Daubenmire classification, and uses physiographic regions modified from Baldwin (1964) and Franklin and Dyrness (1973). Nothing limits this procedure from being used with the USFWS Cowardin et al. (1979) procedure; everything needed is supplied. It is also conceptually related to ecological site classification at the association/community levels.

Automated Data Processing: The procedure does not appear to be readily converted to a standard data base management system except at the landform level, which will easily fit into a geographic information system. The knowledge supplied in the descriptions would work well in an expert system type of environment.

Limitations and Assumptions: As presented, the author has done a superb job of getting to the manager's need.